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Iikura

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(54) **CONTACT MEMBER, IMAGE CARRIER, AND IMAGE FORMING APPARATUS**

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G03G 15/00 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/751*** (2013.01)

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USPC 399/91, 159, 351
See application file for complete search history.

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(57) **ABSTRACT**

A contact member is supported in contact with an inside of a rotating cylindrical body, and is provided in a substantially arc shape along an inner side surface of the cylindrical body to have both end portions opposed to each other in a state in which the contact member is supported by the cylindrical body, when viewed from an axial direction of the cylindrical body. The contact member has a gate mark serving as an injection port for a resin material at a position recessed from an outer peripheral surface of the contact member.

6 Claims, 10 Drawing Sheets

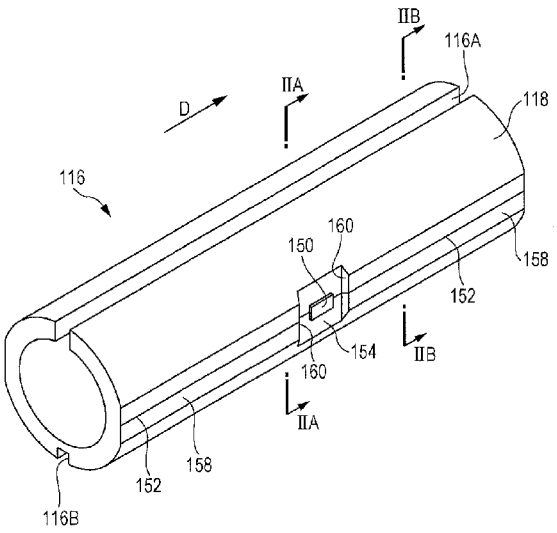


FIG. 1A

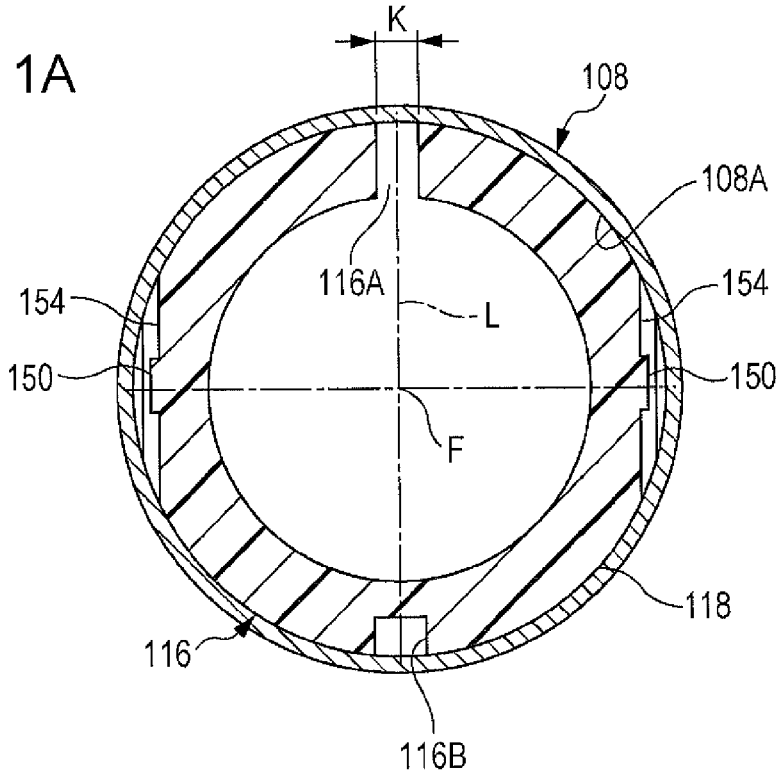
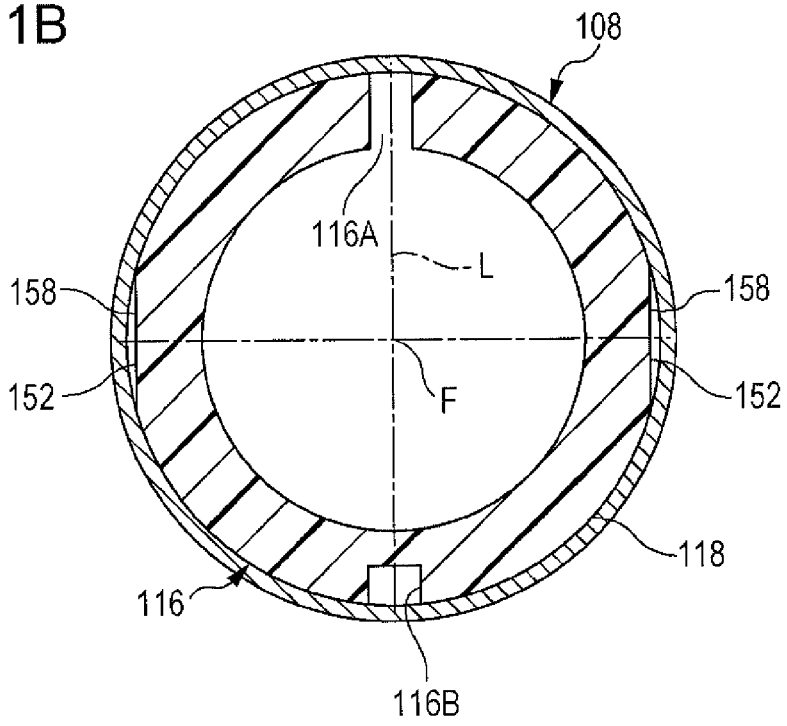

K
108
108A
116A
L
154
154
150
150
F
118
116
116B

FIG. 1B


108
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L
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158
152
152
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118
116
116B

FIG. 2A

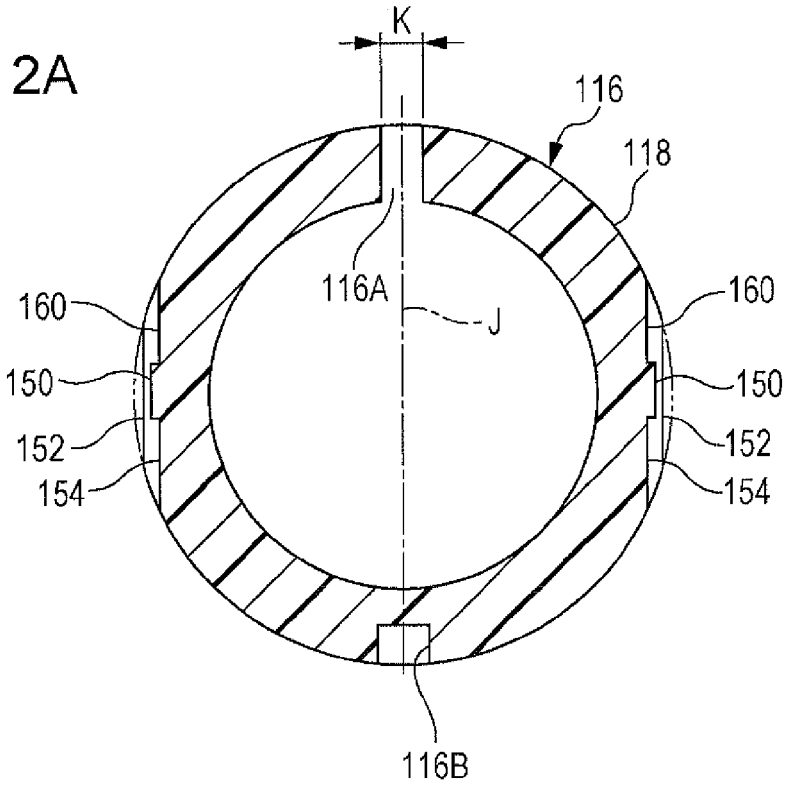

K
116
118
116A
J
160
160
150
150
152
152
154
154
116B

FIG. 2B

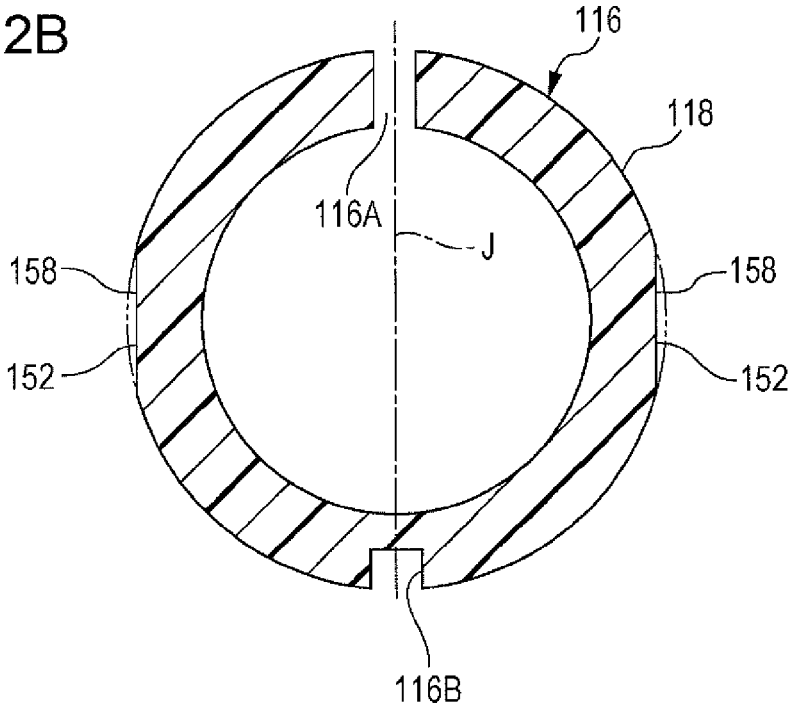

116
118
116A
J
158
158
152
152
116B

FIG. 3

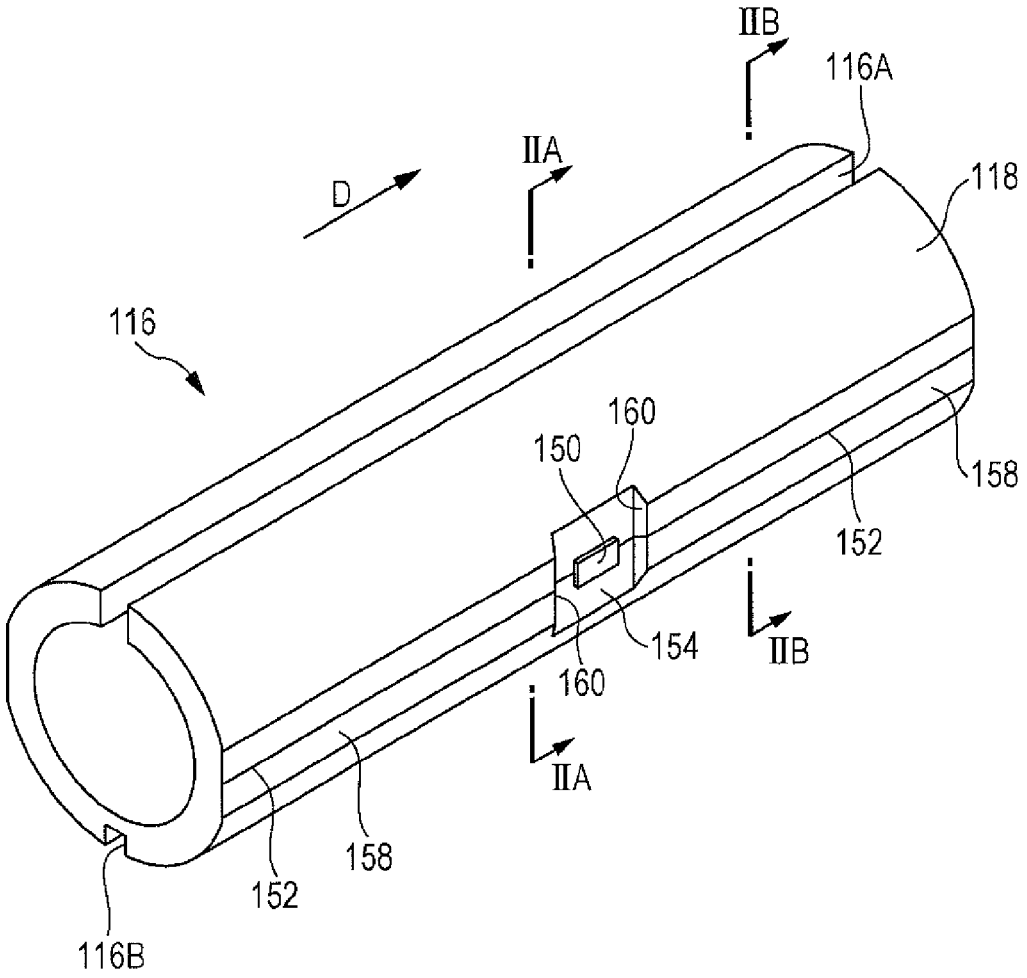

IIB
116A
IIA
D
118
116
160
150
158
152
154
IIB
160
IIA
158
152
116B

FIG. 4A

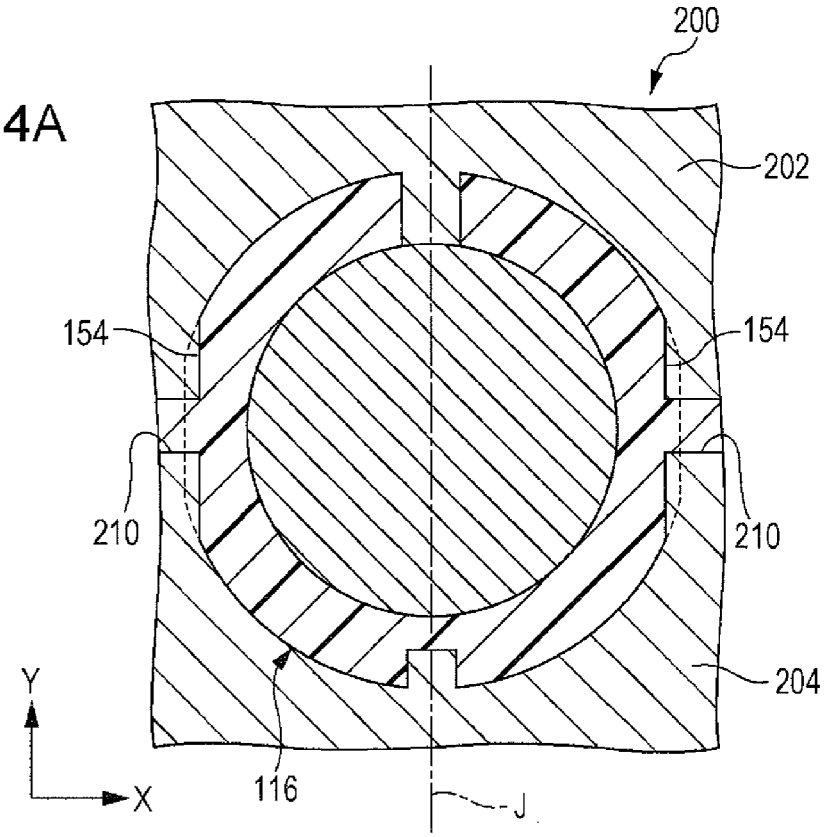
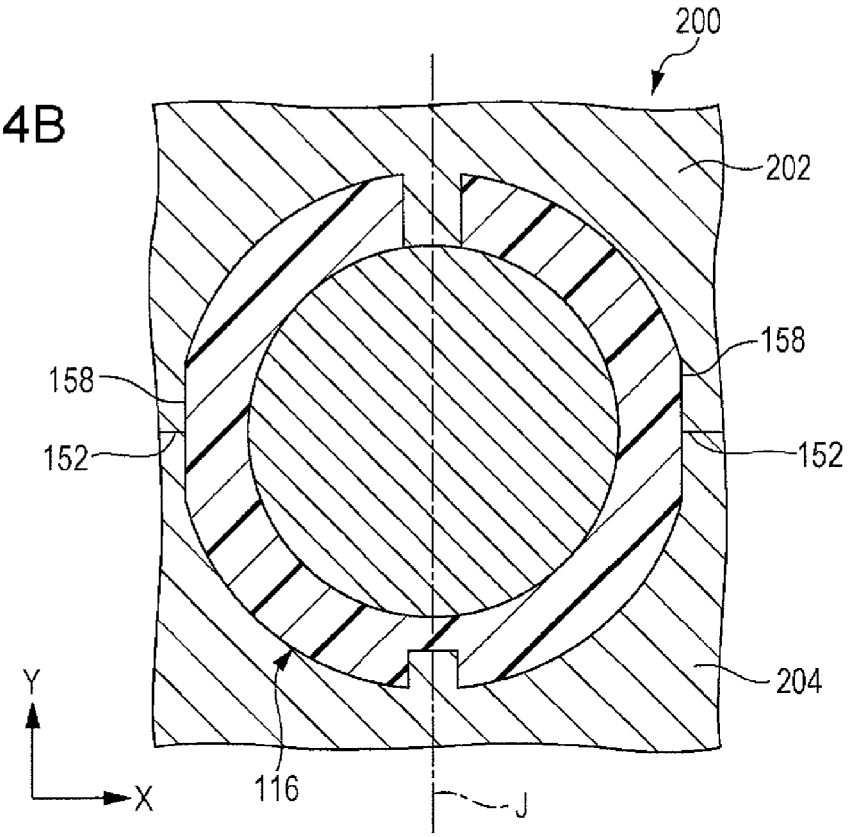

200
202
154
154
210
210
204
Y
X
116
J

FIG. 4B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202
158
158
152
152
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Y
X
116
J

FIG. 5A

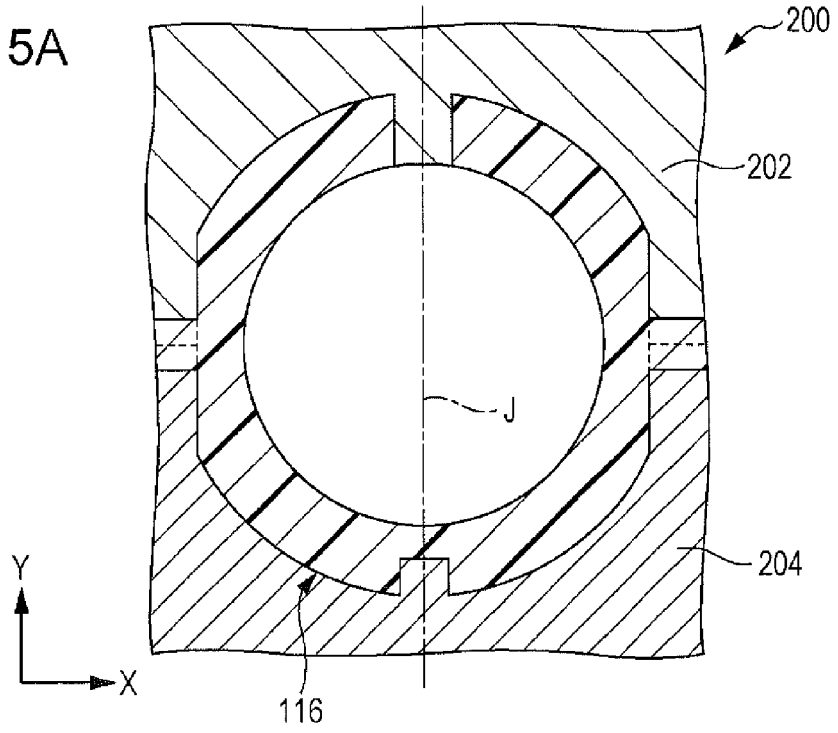
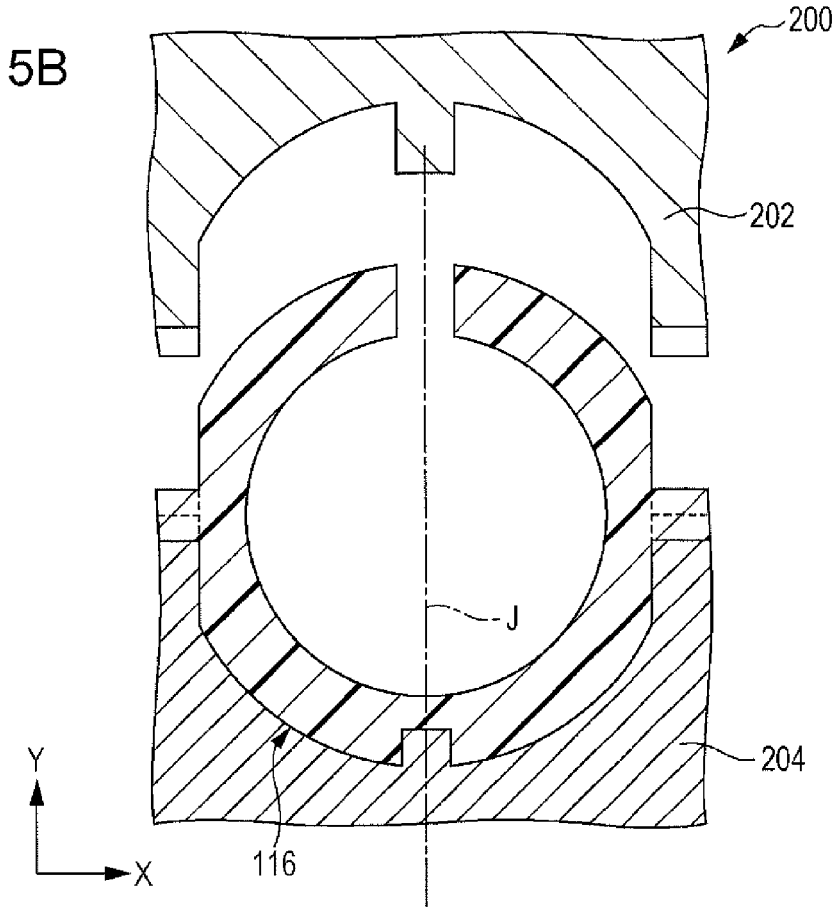


FIG. 5B



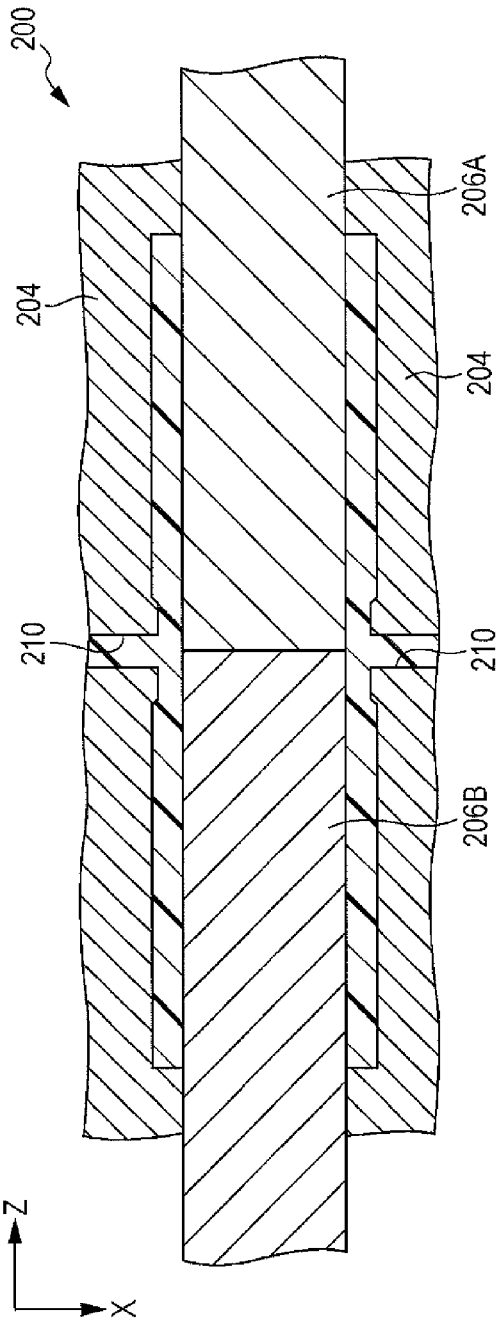
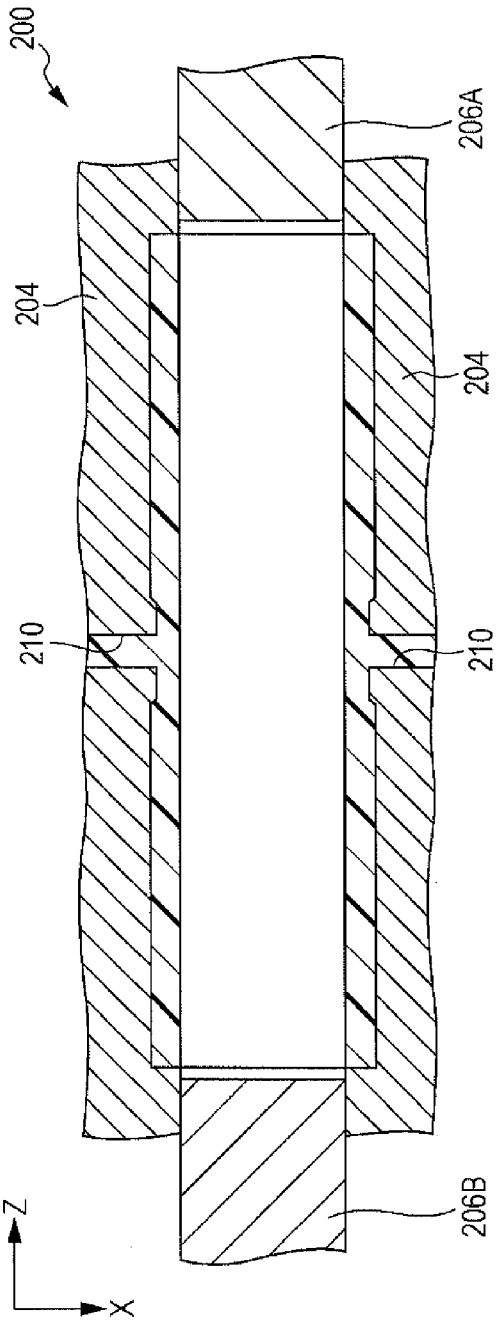

200
206A
204
204
210
210
206B
Z
X

FIG. 6A


200
206A
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204
210
210
206B
Z
X

FIG. 6B

FIG. 7

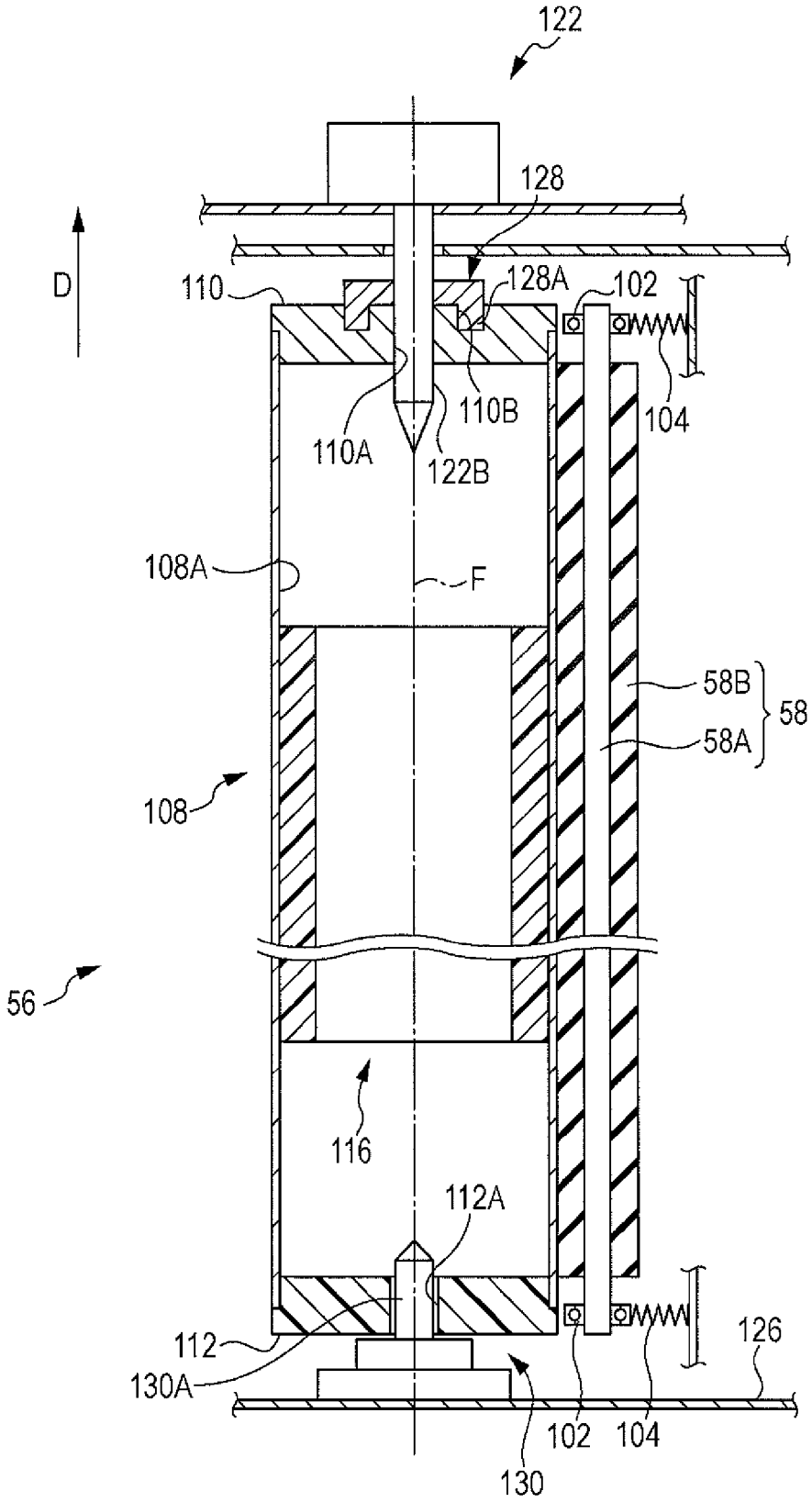

122
128
D
110
128A
102
104
110B
110A
122B
108A
F
58B
58
58A
108
56
116
112A
112
126
130A
102
104
130

FIG. 8

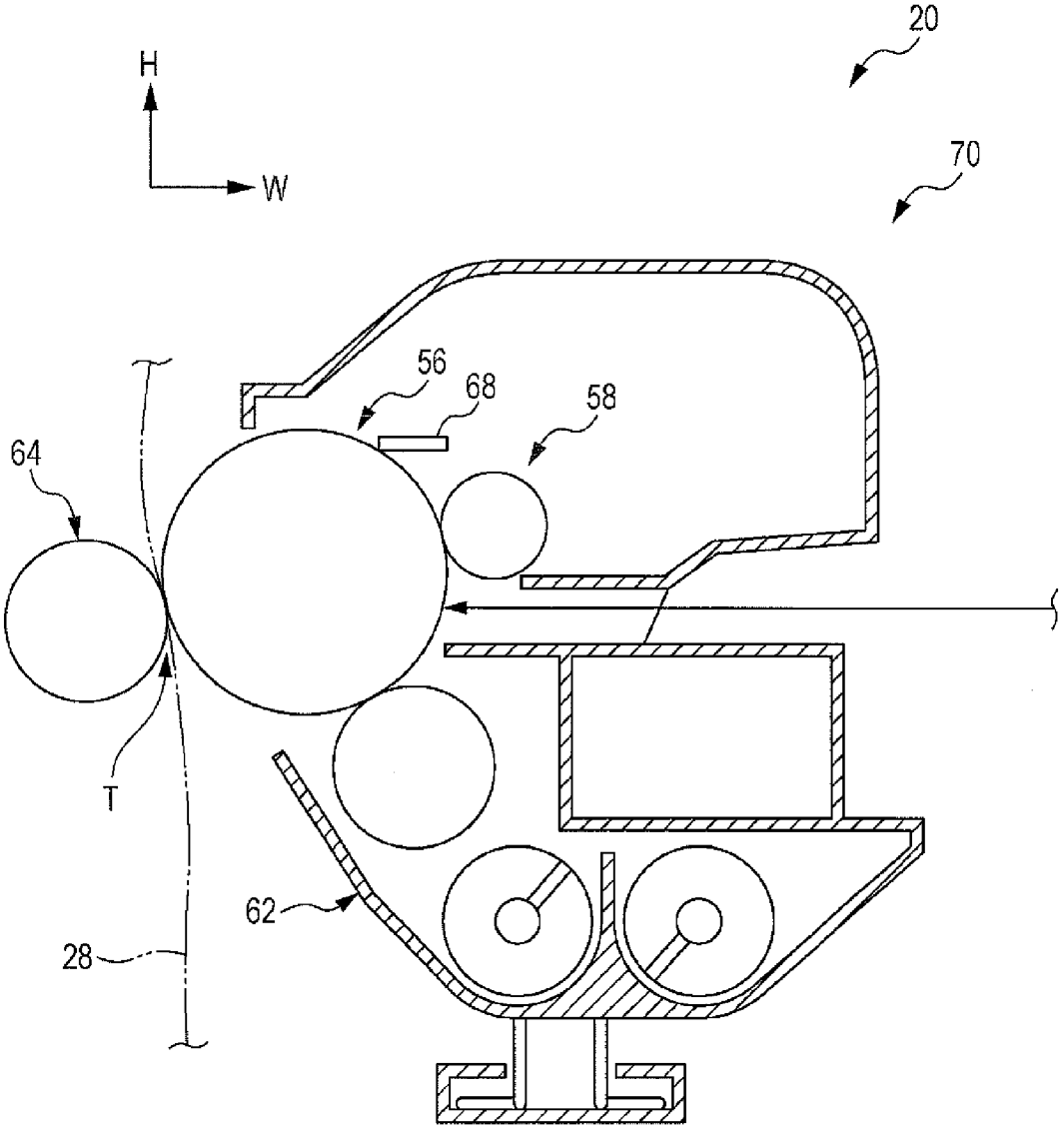


FIG. 9

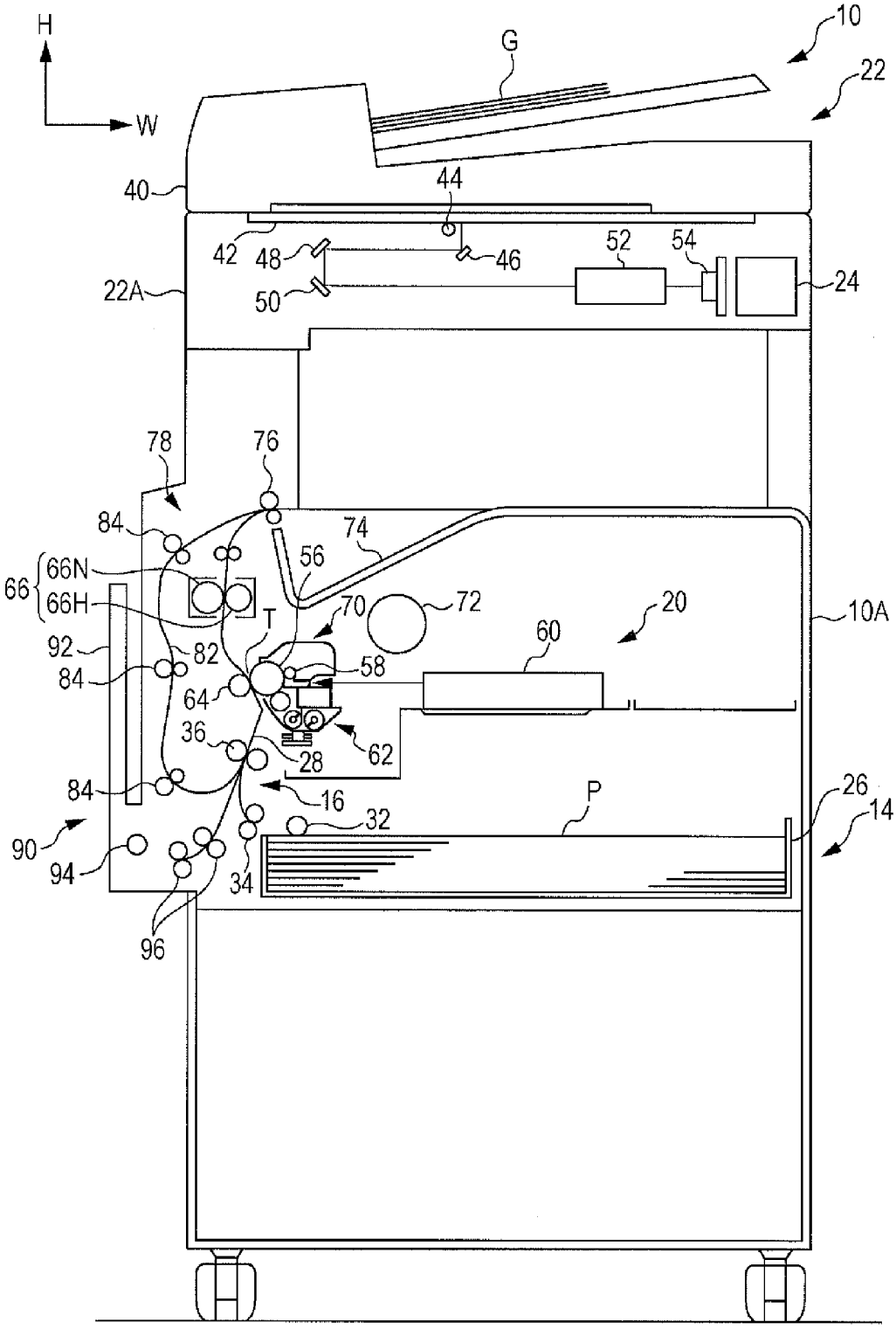

H
W
G
10
22
40
44
42
48
46
52
54
24
22A
50
78
76
84
74
56
66
66N
66H
T
70
72
20
10A
92
82
60
84
58
64
36
62
28
84
16
P
26
14
32
90
94
34
96

FIG. 10A

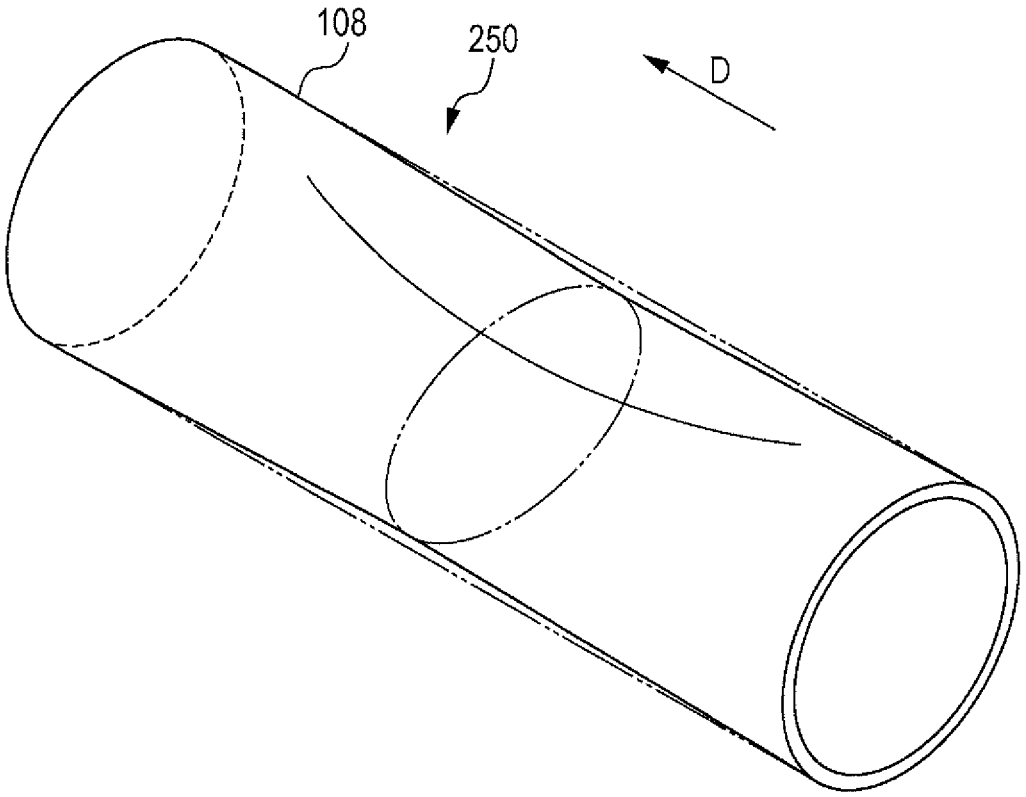
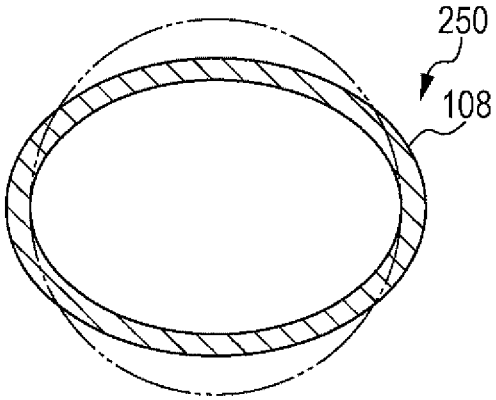


FIG. 10B



CONTACT MEMBER, IMAGE CARRIER, AND IMAGE FORMING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based on and claims priority under 35 USC 119 from Japanese Patent Application No. 2014-127337 filed Jun. 20, 2014.

BACKGROUND

(i) Technical Field

The present invention relates to a contact member, an image carrier, and an image forming apparatus.

(ii) Related Art

In the past, contact members to be disposed within image carriers (photoconductor drums) have hitherto been formed by extrusion. However, contact members are sometimes formed by injection molding for cost reduction. In this case, when molding a contact member, a resin material is sometimes injected into a mold from a side of an outer peripheral surface of the contact member to increase accuracy of the outer peripheral surface.

However, the protrusion amount of a gate mark serving as an injection port for the resin material varies. For this reason, the vibration characteristics of an image carrier in which the contact member is disposed sometimes vary.

SUMMARY

According to an aspect of the invention, there is provided a contact member supported in contact with an inside of a rotating cylindrical body, and provided in a substantially arc shape along an inner side surface of the cylindrical body to have both end portions opposed to each other in a state in which the contact member is supported by the cylindrical body, when viewed from an axial direction of the cylindrical body. The contact member has a gate mark serving as an injection port for a resin material at a position recessed from an outer peripheral surface of the contact member.

BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary embodiment of the present invention will be described in detail based on the following figures, wherein:

FIGS. **1**A and **1**B are cross-sectional views illustrating a state in which a contact member according to an exemplary embodiment is supported within a cylindrical body;

FIGS. **2**A and **2**B are cross-sectional views of the contact member of the exemplary embodiment;

FIG. **3** is a perspective view of the contact member of the exemplary embodiment;

FIGS. **4**A and **4**B are cross-sectional views illustrating a mold structure used to mold the contact member of the exemplary embodiment;

FIGS. **5**A and **5**B are cross-sectional views illustrating the mold structure used to mold the contact member of the exemplary embodiment;

FIGS. **6**A and **6**B are cross-sectional views illustrating the mold structure used to mold the contact member of the exemplary embodiment;

FIG. **7** is a cross-sectional view of an image carrier according to the exemplary embodiment;

FIG. **8** is a structural view illustrating the image carrier and so on according to the exemplary embodiment;

FIG. **9** is a schematic configuration view of an image forming apparatus according to the exemplary embodiment; and

FIGS. **10**A and **10**B are a perspective view and a cross-sectional view, respectively, of an image carrier according to a comparative example in contrast to the image carrier of the exemplary embodiment.

DETAILED DESCRIPTION

A contact member, an image carrier, and an image forming apparatus according to an exemplary embodiment of the present invention will be described with reference to FIGS. **1**A and **1**B to FIG. **9**. In the figures, arrow H shows the apparatus up-down direction (vertical direction), arrow W shows the apparatus width direction (horizontal direction), and arrow D shows the apparatus depth direction (horizontal direction).

Overall Configuration

As illustrated in FIG. **9**, in an image forming apparatus **10** according to the exemplary embodiment, a storage section **14**, a transport section **16**, an image forming section **20**, and a document reading section **22** are provided in this order from a lower side toward an upper side in the apparatus up-down direction (direction of arrow H). The storage section **14** stores sheet members P serving as recording media. The transport section **16** transports the sheet members P stored in the storage section **14**. The image forming section **20** forms images on the sheet members P transported from the storage section **14** by the transport section **16**. The document reading section **22** reads a read document G. The image forming apparatus **10** further includes a manual paper feed section **90** from which a sheet member P is supplied manually.

Storage Section

The storage section **14** includes a storage member **26** that can be drawn out from an apparatus body **10**A of the image forming apparatus **10** toward a front side in the apparatus depth direction. In the storage member **26**, sheet members P are stacked. The storage section **14** further includes a feed roller **32** that feeds out the stacked sheet members P to a transport path **28** that configurates the transport section **16**.

Transport Section

The transport section **16** includes separation rollers **34** disposed on a downstream side of the feed roller **32** in a transport direction of sheet members P (hereinafter simply referred to as a "transport-direction downstream side") to separate and transport the sheet members P one by one.

On the transport-direction downstream side of the separation rollers **34** in the transport path **28**, registration rollers **36** are disposed to temporarily stop a sheet member P and to feed out the sheet member P to a transfer position T (to be described later) at a predetermined timing.

At a terminal end of the transport path **28**, output rollers **76** are disposed to output a sheet member P, on which an image is formed by the image forming section **20**, into an output portion **74** provided above the image forming section **20**.

To form images on both sides of a sheet member P, a double-side transport unit **78** for inverting the sheet member P is provided in a side part of the apparatus body **10**A. The double-side transport unit **78** includes a reverse path **82** into which a sheet member P is transported by reversing the output rollers **76**. Further, plural transport rollers **84** are disposed along the reverse path **82**. The sheet member P sent by the transport rollers **84** is transported to the registration rollers **36** again in an inverted state.

Manual Paper Feed Section

Next to the double-side transport unit **78**, the folding manual paper feed section **90** is provided. The manual paper

feed section **90** includes an openable manual paper feed member **92**. The manual paper feed section **90** further includes a paper feed roller **94** and plural transport rollers **96** that transport a sheet member P fed from the open manual paper feed member **92**. The sheet member P transported by the transport rollers **96** is transported to the registration rollers **36**.

Document Reading Section

The document reading section **22** provided in the upper part of the image forming apparatus **10** includes a light source **44** that radiates light onto a read document G transported by an automatic document transport device **40** for transporting the read document G or a read document G placed on a platen glass **42**.

The document reading section **22** further includes an optical system configurated by a full-rate mirror **46**, a half-rate mirror **48**, a half-rate mirror **50**, and an imaging lens **52**. Light radiated from the light source **44** is reflected by a read document G, and the reflected light is reflected by the full-rate mirror **46** in a direction parallel to the platen glass **42**. The half-rate mirror **48** reflects the reflected light from the full-rate mirror **46** in a downward direction. The half-rate mirror **50** reflects and folds back the reflected light from the half-rate mirror **48** in the direction parallel to the platen glass **42**. The reflected light folded back by the half-rate mirror **50** enters the imaging lens **52**.

The document reading section **22** further includes a photoelectric conversion element **54** that converts the reflected light imaged by the imaging lens **52** into electric signals, and an image processing unit **24** that subjects the electric signals converted by the photoelectric conversion element **54** to image processing.

The light source **44**, the full-rate mirror **46**, the half-rate mirror **48**, and the half-rate mirror **50** are movable along the platen glass **42**. To read a read document G placed on the platen glass **42**, the light source **44** radiates light onto the read document G while moving the light source **44**, the full-rate mirror **46**, the half-rate mirror **48**, and the half-rate mirror **50**. Reflected light from the read document G is imaged on the photoelectric conversion element **54**.

To read a read document G transported by the automatic document transport device **40**, the light source **44**, the full-rate mirror **46**, the half-rate mirror **48**, and the half-rate mirror **50** are stopped. The light source **44** radiates light onto the read document G, and reflected light from the read document G is imaged on the photoelectric conversion element **54**.

Image Forming Section

As illustrated in FIG. **8**, the image forming section **20** includes an image carrier **56**, a charging roller **58** (an example of a charging member), an exposure device **60** (an example of an image forming member, see FIG. **9**), and a developing device **62** (an example of an image forming member). The charging roller **58** charges a surface of the image carrier **56**. The exposure device **60** forms an electrostatic latent image by radiating exposure light onto the charged surface of the image carrier **56** according to image data. The developing device **62** develops the electrostatic latent image into a visible toner image.

The image forming section **20** further includes a transfer roller **64**, a fixing device **66** (see FIG. **9**), and a cleaning blade **68**. The transfer roller **64** transfers a toner image formed on the surface of the image carrier **56** onto a sheet member P transported along the transport path **28**. The fixing device **66** is composed of a heating roller **66**H and a pressurizing roller **66**N, and fixes the toner image on the sheet member P with heat and pressure. The cleaning blade **68** cleans the image carrier **56** by scraping residual toner off the image carrier **56** after the toner image is transferred.

As illustrated in FIG. **9**, a toner cartridge **72** connected to the developing device **62** by an unillustrated supply pipe is disposed on an obliquely upper side of the exposure device **60**. The toner cartridge **72** stores toner to be supplied to the developing device **62** through the supply pipe.

In this configuration, when a sheet member P is fed out from the registration rollers **36**, it is transported to the transfer position T defined by the image carrier **56** and the transfer roller **64** and is transported while being nipped therebetween. Thus, a toner image formed on the image carrier **56** is transferred onto the sheet member P.

Here, the image carrier **56**, the charging roller **58**, the developing device **62**, and the cleaning blade **68** configurate an image forming unit **70**. The image forming unit **70** is removably mounted in the apparatus body **10**A.

The image carrier **56**, the charging roller **58**, and so on will be described in detail later.

Operation of Overall Configuration

In the image forming apparatus **10**, an image is formed in the following procedure.

First, the charging roller **58** to which voltage is applied uniformly and negatively charges the surface of the image carrier **56** with a predetermined potential. Next, the exposure device **60** forms an electrostatic latent image by radiating exposure light onto the charged surface of the image carrier **56** on the basis of image data read by the document reading section **22** or externally input data.

The electrostatic latent image corresponding to the image data is thereby formed on the surface of the image carrier **56**. This electrostatic latent image is developed into a visible toner image by the developing device **62**.

A sheet member P is fed out from the storage member **26** into the transport path **28** by the feed roller **32** or is fed from the manual paper feed member **92** into the transport path **28** by the paper feed roller **94**, and is sent to the transfer position T by the registration rollers **36** at a predetermined timing. At the transfer position T, the sheet member P is transported while being nipped between the image carrier **56** and the transfer roller **64**, and the toner image formed on the surface of the image carrier **56** is thereby transferred onto a front surface of the sheet member P.

The transferred toner image is fixed on the sheet member P by passing between the heating roller **66**H and the pressurizing roller **66**N provided in the fixing device **66**. Then, after the toner image is fixed on the front surface of the sheet member P, the sheet member P is output to the output portion **74** by the output rollers **76**.

To also form an image on a back surface of the sheet member P, the sheet member P having the toner image on the front surface is not output to the output portion **74**, but is sent to the reverse path **82** by reversing the output rollers **76**. Thus, the sheet member P is inverted, and the transport rollers **84** transport the sheet member P to the registration rollers **36** again.

This time, a toner image is transferred onto the back surface of the sheet member P at the transfer position T, and the sheet member P is then output to the output portion **74** in the above-described procedure.

Structure of Principal Part

Next, the image carrier **56**, the charging roller **58**, and so on will be described.

Charging Roller

As illustrated in FIG. **7**, the charging roller **58** includes a shaft portion **58**A extending in the apparatus depth direction and made of a metal material (for example, stainless steel),

and a roller portion **58**B made of a rubber material and formed in the shape of a cylinder through which the shaft portion **58**A extends.

Both ends of the shaft portion **58**A are exposed outside from the roller portion **58**B, and are rotatably supported by a pair of bearing members **102**. Biasing members **104** for biasing the bearing members **102** toward the image carrier **56** are disposed on a side of the shaft portion **58**A opposite from the image carrier **56**.

With this structure, the roller portion **58**B of the charging roller **58** is pressed against the image carrier **56**. When the image carrier **56** rotates, the charging roller **58** is rotated along with the rotation. To the shaft portion **58**A, a superimposed voltage obtained by superimposing an alternating-current voltage (1 to 2 kHz) on a direct-current voltage is applied from an unillustrated power supply. Thus, current flows from the charging roller **58** to the image carrier **56**, and the surface of the image carrier **56** is charged.

Image Carrier

As illustrated in FIG. **7**, the image carrier **56** includes a cylindrical body **108**, a transmission member **110**, and a support member **112**. The cylindrical body **108** extends in the apparatus depth direction and is shaped like a cylinder. The transmission member **110** is fixed to one end (upper side in FIG. **7**) of the cylindrical body **108** in the apparatus depth direction (direction similar to the axial direction of the cylindrical body **108**). The support member **112** is fixed to the other end (lower side in FIG. **7**) of the cylindrical body **108** in the apparatus depth direction. The image carrier **56** further includes a contact member **116** disposed within the cylindrical body **108** to suppress deformation of a cross section of the cylindrical body **108**.

The cylindrical body **108** is obtained by forming a photosensitive layer on an outer peripheral surface of a cylindrical base member made of a metal material (for example, aluminum). For example, the cylindrical body **108** has a thickness of 0.8 mm, and a length of 250 mm in the apparatus depth direction.

The transmission member **110** is made of a resin material and formed in a disc shape. The transmission member **110** is fixed to the one end of the cylindrical body **108** with a part thereof being fitted in the cylindrical body **108**, and closes the open one end of the cylindrical body **108**. The transmission member **110** has a columnar through hole **110**A on an axial center F of the cylindrical body **108**. In an outer peripheral surface of the transmission member **110** facing outward in the apparatus depth direction, plural recesses **110**B are provided such that the through hole **110**A is located therebetween.

A motor shaft portion **122**B of a motor **122** for generating rotating force to be transmitted to the transmission member **110** (image carrier **56**) penetrates the through hole **110**A of the transmission member **110**. Also, a distal end portion **128**A of a bracket **128** attached to the motor shaft portion **122**B is bent and inserted in the recesses **110**B of the transmission member **110**.

The support member **112** is made of a resin material and formed in a disc shape. The support member **112** is fixed to the other end of the cylindrical body **108** with a part thereof being fitted in the cylindrical body **108**, and closes the other open end of the cylindrical body **108**. The support member **112** has a columnar through hole **112**A on the axial center F of the cylindrical body **108**.

A shaft portion **130**A of a shaft member **130** that rotatably supports the support member **112** (image carrier **56**) penetrates the through hole **112**A, and the support member **112** functions as a so-called sliding bearing for the shaft portion **130**A.

In this structure, rotating force generated by the motor **122** is transmitted to the transmission member **110** (image carrier **56**) via the bracket **128**, and rotates the image carrier **56** about the axial center F.

Contact Member

Next, a description will be given of the contact member **116** disposed within the cylindrical body **108** to suppress deformation of the cross section of the cylindrical body **108**.

As illustrated in FIG. **7**, the contact member **116** is fitted in the cylindrical body **108**, and is located in the center of the cylindrical body **108** in the apparatus depth direction. As illustrated in FIG. **1**A, the contact member **116** is supported by the cylindrical body **108** with an arc-shaped outer peripheral surface **118** thereof being in contact with an inner peripheral surface **108**A of the cylindrical body **108**.

Specifically, the contact member **116** is made of a resin material (for example, ABS resin), and is formed by injection molding. The contact member **116** is arc-shaped (C-shaped) or substantially arc-shaped such that both end portions are opposed along the inner peripheral surface **108**A of the cylindrical body **108**, when viewed from the apparatus depth direction. Between the opposed end portions, the contact member **116** is partly separated to form a separate space **116**A in the circumferential direction. As illustrated in FIG. **3**, the contact member **116** extends in the apparatus depth direction. For example, the thickness of a general portion of the contact member **116** is 4 mm, and the length of the contact member **116** in the apparatus depth direction is 100 mm.

Further, as illustrated in FIG. **1**A, a groove portion **116**B extending in the apparatus depth direction is provided on a portion of the outer peripheral surface **118** of the contact member **116** on a side of the axial center F of the cylindrical body **108** opposite from the separate space **116**A in a state in which the contact member **116** is disposed within the cylindrical body **108**.

In a state in which the contact member **116** is not disposed within the cylindrical body **108** (see FIG. **2**A), a separate distance (distance K in FIG. **2**A) of the separate space **116**A is longer than when the contact member **116** is disposed within the cylindrical body **108** (see FIG. **1**A).

In this structure, when the contact member **116** is disposed within the cylindrical body **108**, it is held and bent by deforming the groove portion **116**B to shorten the separate distance K of the separate space **116**A. In this state, the contact member **116** is inserted into the cylindrical body **108**, the holding force is removed, and the contact member **116** is pushed into the center of the cylindrical body **108**. Thus, the outer peripheral surface **118** of the contact member **116** comes into contact with the inner peripheral surface **108**A of the cylindrical body **108**, and the contact member **116** is disposed and supported within the cylindrical body **108**.

Next, a description will be given of gate marks **150** serving as injection ports for the resin material during injection molding of the contact member **116**, and parting lines **152** where molds for injection molding meet. FIG. **2**A is a cross-sectional view taken along line IIA-IIA of FIG. **3**, and FIG. **2**B is a cross-sectional view taken along line IIB-IIB of FIG. **3**. The IIA-IIA cross-sectional view shows a cross section of the contact member **116** in the center in the apparatus depth direction, and the IIB-IIB cross-sectional view shows a cross section of the contact member **116** in the end portion in the apparatus depth direction.

As illustrated in FIG. **2**A, the contact member **116** has two flat portions **154** that are recessed by, for example, about 0.8 mm from the outer peripheral surface **118**. The two flat portions **154** are positioned symmetrically with respect to a straight line J passing through the center of the separate space

116A and the center of the groove portion 116B, when viewed from the apparatus depth direction. The flat portions 154 have their respective gate marks 150. As illustrated in FIG. 3, the flat portions 154 having the gate marks 150 are located in the center of the outer peripheral surface 118 in the apparatus depth direction. As illustrated in FIG. 2A, the flat portions 154 are each shaped like a straight line parallel to the straight line J, when viewed from the apparatus depth direction.

As illustrated in FIGS. 2B and 3, on both sides of the flat portions 154 in the apparatus depth direction, flat portions 158, which are recessed by, for example, about 0.6 mm from the outer peripheral surface 118, extend in the apparatus depth direction. The recess amount of the flat portions 158 from the outer peripheral surface 118 is less than the recess amount of the flat portions 154 (see FIGS. 2A and 2B). Base end portions of the flat portions 158 are connected to the flat portions 154 via stepped portions 160, and distal end portions of the flat portions 158 extend to the end portions of the contact member 116. As illustrated in FIG. 2B, the flat portions 158 are each shaped like a straight line parallel to the straight line J, when viewed from the apparatus depth direction.

In contrast, as illustrated in FIG. 3, the parting lines 152 are provided in the flat portions 154, the stepped portions 160, and the flat portions 158, and extend from the gate marks 150 to both ends in the apparatus depth direction with their end portions being in contact with the gate marks 150.

In this structure, as illustrated in FIG. 1A, the gate marks 150 are separate from the inner peripheral surface 108A of the cylindrical body 108 in a state in which the contact member 116 is supported within the cylindrical body 108.

Similarly, as illustrated in FIG. 1B, the parting lines 152 are separate from the inner peripheral surface 108A of the cylindrical body 108 in the state in which the contact member 116 is supported within the cylindrical body 108.

As illustrated in FIG. 2A, the two gate marks 150 are symmetrically located with respect to the straight line J, when viewed from the apparatus depth direction. In other words, as illustrated in FIG. 1A, in the state in which the contact member 116 is supported within the cylindrical body 108, the two gate marks 150 are symmetrically located with respect to a straight line L passing through the center of the separate space 116A and the axial center F, when viewed from the apparatus depth direction. Further, the two gate marks 150 are located at similar positions in the apparatus depth direction. The gate marks 150 are regarded as being located at similar positions when even a part of one of the gate marks 150 overlaps with the other gate mark 150.

Mold Structure

Next, a mold mechanism 200 used to form the contact member 116 by injection molding will be described with reference to FIGS. 4A, 4B, 5A, 53, 6A, and 6B.

In the description of the mold mechanism 200, the longitudinal direction of the contact member 116 is referred to as a member longitudinal direction (arrow Z in FIGS. 4A and 4B to FIGS. 6A and 6B), and the extending direction of the above-described straight line J is referred to as a member up-down direction (arrow Y in FIGS. 4A and 4B to FIGS. 6A and 6B), when viewed from the member longitudinal direction. Further, the direction orthogonal to the member up-down direction is referred to as a member width direction (arrow X in FIGS. 4A and 4B to FIGS. 6A and 6B), when viewed from the member longitudinal direction.

As illustrated in FIGS. 4A and 4B, the mold mechanism 200 includes a cavity mold 202 (an example of a mold) to be in contact with an upper side in the member up-down direction of a surface of a contact member 116 facing outward, and a core mold 204 (an example of a mold) to be in contact with a lower side of the surface. As illustrated in FIG. 6A, the mold mechanism 200 further includes a pair of sliding molds 206A and 206B to be in contact with a surface of the contact member 116 facing inward.

As illustrated in FIGS. 6A and 6B, the pair of sliding molds 206A and 206B are moved by an unillustrated moving member in the member longitudinal direction to separate from each other from a state in which the molds are set. As illustrated in FIGS. 5A and 5B, the cavity mold 202 is moved by an unillustrated moving member upward in the member up-down direction to separate from the core mold 204 from the state in which the molds are set.

Further, as illustrated in FIGS. 4A and 6A, in the center of the mold mechanism 200 in the member longitudinal direction, two gate portions 210 through which a melted resin material flows are provided symmetrically with respect to the straight line J (see FIG. 4A).

In this structure, the melted resin material is injected into the mold mechanism 200 from the gate portions 210 in the state in which the molds are set, and is then solidified (cured) by cooling. Then, as illustrated in FIGS. 6A and 6B, the sliding molds 206A and 206B are moved in the member longitudinal direction to separate from each other. Further, as illustrated in FIGS. 5A and 5B, the cavity mold 202 is moved upward in the member up-down direction. Then, a resin member is demolded and the gates are cut, so that a contact member 116 is formed.

The protrusion amount of gate marks 150 remaining after gate cutting varies among components. The gate marks 150 sometimes protrude by a maximum of about 0.4 mm from the flat portions 154. If the cavity mold 202 and the core mold 204 are misaligned, the height difference at the parting lines 152 varies among components. The height difference at the parting line 152 sometimes becomes about 0.4 mm at the maximum.

Operation of Principal Structure

Next, the operations of the image carrier 56, the charging roller 58, and so on will be described.

When the motor 122 is operated, the image carrier 56 rotates (see FIG. 7). When the image carrier 56 rotates, the charging roller 58 is rotated along with the rotation. To charge the unillustrated photosensitive layer of the image carrier 56, a superimposed voltage obtained by superimposing an alternating-current voltage (1 to 2 kHz) on a direct-current voltage is applied from the power supply to the shaft portion 58A of the charging roller 58.

By the alternating-current voltage included in the superimposed voltage, an alternating electric field is generated between the charging roller 58 and the image carrier 56. Thus, a periodic electrostatic attractive force (2 to 4 kHz) is generated between the image carrier 56 and the charging roller 58.

Here, an image carrier 250 according to a comparative example will be described in contrast to the image carrier 56 of the exemplary embodiment with reference to FIGS. 10A and 10B.

First, the image carrier 250 will be described. The image carrier 250 has a structure similar to that of the image carrier 56 except that the contact member 116 is not provided.

FIGS. 10A and 10B exaggeratedly illustrate an example of a deformed state of a cylindrical body 108 of the image carrier 250 when a periodic electrostatic attractive force is generated between the image carrier 250 and a charging roller 58. Since a transmission member 110 and a support member 112 are fixed to opposite ends of the cylindrical body 108 in the apparatus depth direction (see FIG. 7), deformation of a cross section of the cylindrical body 108 is suppressed at the oppo-

site ends in the apparatus depth direction. In contrast, in the center portion of the cylindrical body **108** in the apparatus depth direction, the cross section of the cylindrical body **108** periodically deforms in an elliptic shape and a circular shape, as illustrated in FIG. **10**B.

However, unlike the image carrier **250** of the comparative example, the image carrier **56** of the exemplary embodiment is provided with the contact member **116**. As illustrated in FIGS. **1**A and **1**B, the contact member **116** is supported by the cylindrical body **108** with the outer peripheral surface **118** being in contact with the inner peripheral surface **108**A of the cylindrical body **108**.

The foregoing description of the exemplary embodiment of the present invention has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiment was chosen and described in order to best explain the principles of the invention and its practical applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

For example, the contact member **116** has the groove portion **116**B and is bent and placed within the cylindrical body **108** while deforming the groove portion **116**B in the exemplary embodiment. However, it is not always necessary to form the groove portion **116**B. When being placed within the cylindrical body **108**, the contact member **116** may be bent entirely.

While the gate marks **150** are provided at two positions in the exemplary embodiment, a gate mark **150** may be provided at one position or three or more positions.

While the two gate marks **150** are located in the center portion in the apparatus depth direction in the exemplary embodiment, it is only necessary that the two gate marks **150** should be located at similar positions in the apparatus depth direction.

While the stepped portions **160** are provided in the contact member **116** in the exemplary embodiment, they do not always need to be provided.

What is claimed is:

1. A contact member supported in contact with an inside of a rotating cylindrical body, and provided in a substantially arc shape along an inner side surface of the cylindrical body to have both end portions opposed to each other in a state in which the contact member is supported by the cylindrical body, when viewed from an axial direction of the cylindrical body, the contact member having a gate mark serving as an injection port for a resin material at a position recessed from an outer peripheral surface of the contact member, the gate mark extending radially outwardly from within a recessed flat portion along the outer peripheral surface of the contact member such that a gap is formed between a radially outer end of the gate mark and an inner peripheral surface of the rotating cylindrical body.

2. The contact member according to claim **1**,

wherein the gate mark includes two gate marks, and

wherein, in the state in which the contact member is supported by the cylindrical body, the two gate marks are located symmetrically with respect to a straight line passing through a center of a separate space provided between the opposed end portions and a center of the cylindrical body, when viewed from the axial direction.

3. The contact member according to claim **2**, wherein the two gate marks are located at similar positions in the axial direction.

4. The contact member according to claim **1**, wherein a parting line where molds meet is provided at a position recessed from the outer peripheral surface.

5. An image carrier comprising:

a rotating cylindrical body whose surface is to be charged; and

the contact member according to claim **1**, the contact member being fitted within the cylindrical body.

6. An image forming apparatus comprising:

the image carrier according to claim **5**;

a charging member to which a superimposed voltage obtained by superimposing an alternating-current voltage on a direct-current voltage is applied to charge the surface of the image carrier; and

an image forming member that forms an image on the charged surface of the image carrier.

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